EXAM 1
Zoology 313 -- Spring 2001

Please provide a short answer to all of the questions below. In most cases you should be able to answer them with a single sentence or even a sentence fragment. In some cases you can give a list of a few words or sentences. Feel free to use a diagram if it will make you understanding of the topic clearer. Total points: 100.

1. What is “Morgan's Canon”? (Describe the essence of it in your own words--i.e., don’t worry about quoting it accurately.) (5 pts.)
   Prefer simpler explanations over complex ones

2. Recall Niko Tinbergen’s studies of digger wasps (in the film Signs and Signals), in which he discovered that wasps found their nests by reference to landmarks surrounding it. I would like you to think about this as an example of “strong inference” science. Remember that the basic question Tinbergen was trying to answer was how wasps find their nests, and that the experiment provided support for the hypothesis that wasps learn surrounding landmarks. You have two tasks:

   a. State one hypothesis other than the landmark hypothesis that was tested by Tinbergen’s experiment (there are at least two others), and explain how the experiment provided evidence against it (6 pts.)

   Hypothesis: Odors emanating from nest

   How the experiment provides evidence against it: wasps searched amidst landmarks even though odors from nest would have been present just a short distance away [NB: I accepted other answers]

   b. This research is an example of which of Tinbergen’s four “Levels of Analysis”? (4 pts.)
   Mechanisms/physiological causation

3. Questions about learning:

   a. State one key similarity between “classical conditioning” and “trial-and-error learning.” (5 pts.)
   animal changes behavior after experiencing association between two events [other similarities: E1 comes before E2; usually latency from E1 to E2 is short, etc. etc.]

   b. State one key difference between these types of learning. (5 pts.)
   CC: E1 is initially neutral stimulus
   T&E: E1 is initially neutral behavior

4. Pavlov proposed the “reflex” as the fundamental unit of behavior. Lorenz proposed the “Fixed Action Pattern” as the fundamental unit of behavior. State one fundamental difference between these two concepts. (5 pts.)
   Reflexes are simpler--e.g. muscle twitch--whereas FAPs are complex sequences of actions (e.g., goose egg rolling)

********PUT YOUR NAME ON ALL PAGES********
5. Some honey bee facts concerning juvenile hormone (JH) and the behavioral changes that worker bees undergo as they age (this is from textbook):
   • young worker bees tend to be “nurses” and have low levels of JH in their blood
   • old worker bees tend to be foragers and have high levels of JH in their blood
   • sometimes young workers speed up their development and become “precocious foragers” and have high levels of JH in their blood
   • sometimes old workers revert to nursing and their JH levels go down.

   a. From these facts, can you conclude that JH is the cause of the behavioral changes? Why or why not? (4 pts.)
      No—correlation doesn’t prove causation; behavior change may cause JH change, or some third factor may cause both

   b. Assuming JH does cause the behavioral changes, what do these facts tell you about the possible activational versus organizational role played by the hormone? (6 pts.)
      Most likely it plays activational role, because effects act in already formed brain of bee, are reversible, and appear to act as switches to turn on and off behavior

6. Data from Table 3.1 in book: Familial correlations for IQ scores based on the genetic differences hypothesis versus actual correlations—used to study heritability of IQ as a trait.

<table>
<thead>
<tr>
<th>Category</th>
<th>Predicted Correlation</th>
<th>Actual median Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identical twins reared together</td>
<td>1.0</td>
<td>0.85</td>
</tr>
<tr>
<td>Identical twins reared apart</td>
<td>1.0</td>
<td>0.67</td>
</tr>
<tr>
<td>Fraternal twins reared together</td>
<td>0.5</td>
<td>0.58</td>
</tr>
<tr>
<td>Genetic parent-child</td>
<td>0.5</td>
<td>0.39</td>
</tr>
<tr>
<td>Adoptive parent--child</td>
<td>0.0</td>
<td>0.18</td>
</tr>
</tbody>
</table>

   a. In class I described five general methods for studying the role of genes producing behavioral traits. Which method is this study an example of? (4 pts.)
      Comparing relatives

   b. Explain what the “predicted” and “actual” correlations are, and why they differ. (4 pts.)
      “Predicted” is based on assumption that IQ similarities/differences are solely determined by genetic differences; “Actual” is different because of environmental influences
7. In the film “Signs and Signals” we saw that male sticklebacks were driven crazy when a red mail van passed by the window.

a. How does this provide evidence for the concept of “key features” or “sign stimuli”? (5 pts.)
   Red is used to recognize territorial males; apparently shape and size cues aren’t relevant

b. List two other examples (from films, book or lecture) of “key features” or “sign stimuli” (5 pts.)
   1. Egg-rolling by goose triggered by convex, unbroken contours
   2. Bill-pecking by baby herring gull triggered by contrasting small spot near end of pointy thing etc. etc. [I accepted several other examples]

8. In white-crowned sparrows, the song developed by males depends upon their experience. The questions here concern exactly how different types of experience play a role in song development

a. State the TWO ways in which auditory experience plays a role (6 pts.)
   1. Male needs to hear example of species-specific song
   2. Male needs to hear himself practice

b. How does social experience play a role? (4 pts.)
   If male sees as well as hears another male singing song, he is capable of more vocal flexibility (e.g., learning later in life; learning other species’ songs)

9. “Constraints on learning”

a. What does this term (“constraints on learning”) mean? (5 pts.)
   Species or sex-specific limits on the speed, timing or flexibility of learning

b. What is one line of evidence for “constraints on learning” (from the book or from lecture)? (5 pts.)
   Cue-consequence specificity in conditioned taste aversion
   [I accepted several other answers, e.g., sensitive periods in imprinting or bird song learning, adaptive specialization of spatial learning in birds....]

10. Neurons and receptors

a. State one key similarity between neurons and receptors? (4 pts.)
   They are excitable (and they conduct signals in one direction, and they pass signals to other neural elements.....)

b. What is the most important difference between neurons and receptors (4 pts.)
   Neurons receive input from other neural elements, receptors receive input from outside the nervous system

c. What is the most common way for a neuron to pass its signal to another neuron? (2 pts.)
   Chemical synapses

********PUT YOUR NAME ON ALL PAGES********
11. This figure shows an “actigram,” or activity rhythm, for a hypothetical animal. Study this actigram and answer the following questions about the animal.

a. Is the animal nocturnal or diurnal? (4 pts.)
   Nocturnal

b. What is the period, “tau,” of this animal’s free-running circadian rhythm? (an estimate to the nearest hour will suffice) (4 pts.)
   26-27 hours [while free running, animal starts activity about 2-3 hours later than it did the day before, so period is 24 + 2 (or 24 +3)]

c. What is the “Zeitgeber” for this rhythm? (4 pts.)
   Light [or light-dark cycle]